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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/768,773	01/29/2004	Daniel C. Edelstein	END920030116US1	7040
30449	7590	09/21/2005	EXAMINER	
SCHMEISER, OLSEN + WATTS			ABRAHAM, FETSUM	
3 LEAR JET LANE			ART UNIT	
SUITE 201			PAPER NUMBER	
LATHAM, NY 12110			2826	

DATE MAILED: 09/21/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/768,773

Applicant(s)

EDELSTEIN ET AL. 

Examiner

Fetsum Abraham

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 18 July 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 31-61 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 31,32,34,36,40,-44 is/are rejected.
- 7) ☒ Claim(s) 33,35,37-39,45-61 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### **Final Rejection**

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**Claims 31,32,34,40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Burghartz et al (5,793,272).**

As for claim 31, the patent discloses an inductor in figure 11 comprising a top surface, the surface covered by layer (20'), a bottom surface, the surface covered by conductor (18), and sidewalls, the outer surfaces of element (26) that are covered by layer (18'), a lower portion of the inductor (104) extending into but not completely through a single dielectric layer (14) formed on semiconductor substrate (12) and the upper portion of the inductor extending above the dielectric layer (14), the inductor provided with means of electrical contact (22, 24) (see the front page figure).

The prior art discloses all subject matter claimed but may have used a second dielectric layer (14') on the first dielectric layer (14) where said upper portion extends into. However, the second dielectric layer is immaterial in the context of the claimed structure because the upper portion is indeed above the first dielectric layer irrespective of the existence of the second dielectric layer. Therefore, it would be obvious s to one

skilled in the art to safely conclude the claim expression "single dielectric layer" as fully addressed by layer 14 since the layer functions independent of the second layer formed on it.

As for claim 32, the lower portion of the inductor composed of a core conductor (104) and a conductive liner (18).

As for claim 34, the upper portion and at least one side surface of the inductor in figure 11 are covered by passivation conductive coating (18', 20'). Although the figure does not show the whole structure in the trench, which is shown in figure 10, it would be clear to that the elements associated with one of the vertical elements (26) would also apply to its other pair. Besides, the patent does not discriminate the other pair because both vertical elements are assigned (26) further indicating their identical nature. This being the concept of the prior art, the sidewalls of elements (26) are provided by the same AlNiCo conductor (18) (see column 5,43-50).

As for claim 40, the horizontally extended portions off the spiral inductor in the prior art extend parallel to the top surface of the dielectric layer.

**Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Burghartz et al (5,793,272) in view of Breen (5,363,080).**

Although the height of a spiral inductor is variable in nature that differs from a design to another based on a specific application, the primary art may have been silent on the height of the inductor. However, the secondary reference discloses an analogous inductor in the front page having coil characterized by a height of more than the claimed 5 microns (see claim 6). Therefore, it would have been obvious to one skilled in the art

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to design any inductor with a height more than 5 microns, since higher inductors induce higher voltages because the height of an inductor is dependent on the inductance of a coil or a wire, which is dependent on the number of turns that is proportional to the induced current in the inductor, which is proportional to the induced voltage from the inductor.

**Claims 41-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Burghartz et al (5,793,272) in view of Goldfarb (5,148,062).**

As for claim 41, the primary reference discloses all subject matter claimed but may have omitted the claimed inductor width and adjacent coil or conductor spacing dimensions. However, the secondary reference discloses a circuit utilizing a spiral inductor having conductors with a width of 20 microns a spacing of 10 microns (see column 5). Please note that the "width" in the claim is taken in this examination as conductor width in view of the broadest possible definition of the presentation.

Therefore, it would have been obvious to one skilled in the art to design an inductor within the dimensions of the claimed invention, depending on what is supposed to be achieved from the product. The motivations that dictate the terms of inductor dimensions include induced voltage from the product, magnetic flux that dictates the terms of generated currents in the inductor, and as the prior art suggests, operation of bandwidth percentage over the frequency range of resonant frequency in a tuning circuit (see column 5, 30-35).

As for claim 42, the primary reference discloses all subject matter claimed but may have omitted the claimed inductor width and adjacent coil or conductor spacing

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dimensions. However, the secondary reference discloses a circuit utilizing a spiral inductor having 5.2 nH of inductance. Therefore, it would have been obvious to one skilled in the art to design an inductor more than the claimed 0.5 nH inductance for specific applications by varying inductor elements, since inductance is a function of length, width, number of turns and other associated elements such as material. Please note that inductance is a variable element notoriously known in the art similar to capacitance and resistance that is subject to a specific application.

As for claims 43,44, the prior arts disclose all subject matter claimed but may have been silent about the Q factor of inductors.

But clearly the Q factor of an inductor can be defined as,

$Q = \omega_0 L / R$  where L is the inductance, R is the characteristic resistance associated with the inductor conductors, and  $\omega_0$  is the resonant frequency of the signal applied in a resonant circuit using the inductor.

Since resonant frequency of a tuning circuit,  $f_r = 1 / (2\pi \sqrt{LC})$  and  $\omega L = 2(\pi)(f_r)$ ,  $Q = 1 / R(\sqrt{L/C})$ .

Therefore, the Q-factor of an inductor can not be determined from the elements associated with the inductor alone but with other elements associated in a given tuning circuit. Clearly, at least capacitance is part of the elements that defines resonant frequency that defines the Q factor associated with a given inductor in the circuit. Therefore, although directly proportional to inductance and inversely proportional to the resistance of inductive conductors, the Q factor involves capacitance and is also a function of resonant frequency.

It is also clear that Goldfarb's inductor has a very high inductance, which produces high Q value when applied in resonant circuits.

Therefore, it would have been obvious to one skilled in the art to expect the inductor of Goldfarb matching the claimed Q-factor value of the claimed invention, since the inductance of the inductor in the patent is higher than the claimed inductance that is claimed to produce the claimed Q when applied in a resonant circuit partially because Q factor is proportional to inductance.

**Claims 33,35,37,38,39,45-61 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.**

As for claim 33, although inductors with barrier liners are known to exist in the art and that Ta and TaN are known materials used as barrier layers of copper, and singularly used as barrier liner in the inductor of PN: 6,717,232, a dual barrier layer composed of the two materials in the inductor of the claimed structure and the effect of the dual layer in improving the electromigration induced problems of the copper composition of the inductor is not taught or rendered obvious by the prior art.

As for claim 35, although Ni and Au have been used as materials associated with inductors, the inductor core material in such a combination had been Gold and the liner material, Nickel. Such an inductor is taught in PN: 6,030,877. However, no prior art seems to have taught an inductor with conductive liner on a lower portion of an inductor and a passivation layer composed of Ni or Au on Ni on the top and sidewall surfaces of an upper inductor portions formed over a single dielectric layer.

As for claim 37, the claimed extension distance of said lower portion into said dielectric layer of the inductor type of the independent claim is not disclosed or rendered obvious by the prior arts.

As for claim 38, although figure 2 of PN: 5,793,272 shows a via within a portion of the insulation layer (14) formed to be filled with a contact material to connect the bottom portion of the inductor with a terminal (22), and that contact vias that penetrate insulation layers to a substrate are common in the art, the claimed contact through a via formed in the dielectric layer and extending from the bottom section of an inductor of claim 31 type and maintaining electrical contact to a metallurgy formed in the substrate supporting the dielectric layer is not taught or rendered obvious by the prior art.

As for claim 45 and its dependents, the claimed contact pad with a via inside the dielectric layer, the via exposing a portion of an I/O terminal pad in the substrate supporting the dielectric layer and the pad partially covered with said passivation layer over a conformal seed layer over a conductive liner in the structure of claim 31 is not taught or rendered obvious by the prior arts.

As for claim 52 and its dependents, the claimed I/O terminal pad in the substrate, the raised contact pad with the claimed structural features and its relationship with said dielectrical layer and the substrate in the specific structure of the independent claim are not taught or rendered obvious by the prior arts.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. See column 2 of PN: 6,666,188 for further information on Q factor.



Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fetsum Abraham whose telephone number is: 571-272-1911. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J Flynn can be reached on 571-272-1915.

Fetsum Abraham

8/28/05

